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Knowledge and Attitudes Toward Modes of Delivery and Postpartum Complications Among Women in the Hail Region, Saudi Arabia

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Abstract **Background:** The global rise in cesarean section (CS) rates has raised concerns about maternal and neonatal health. In Saudi Arabia, increasing CS rates reflect not only medical factors but also cultural beliefs, misconceptions and insufficient antenatal education that influence women's delivery choices. Understanding women's knowledge and attitudes toward different delivery modes is essential to guide targeted health interventions and reduce unnecessary CS procedures. **Objective:** This study assessed the knowledge and attitudes of women in the Hail region, Saudi Arabia, toward vaginal delivery (VD), cesarean section and postpartum complications. It also examined the sociodemographic factors influencing these perspectives. **Methods:** A descriptive cross-sectional study was conducted among 383 women aged 18–45 years in the Hail region between October and December 2024. Data were collected through a validated, structured online questionnaire distributed via Google Forms. Descriptive and inferential statistics, including *t*-tests, ANOVA and correlation analyses, were applied using SPSS version 25, with significance set at $p<0.05$. **Results:** Among participants, 54.6% preferred vaginal delivery, 16.2% preferred cesarean delivery and 29.2% were undecided. The mean overall knowledge score was moderate (M = 64.54, SD = 7.76). Knowledge of vaginal delivery was significantly higher (M = 86.45) compared with cesarean section (M = 57.70) and postpartum complications (M = 49.48) ($p<0.001$). Age, marital status, education and employment status were all significantly associated with knowledge scores. Despite this, awareness of postpartum complications remained low across all demographic groups. **Conclusion:** Although most women in Hail prefer vaginal birth, substantial knowledge gaps persist regarding cesarean risks and postpartum complications. Culturally tailored educational initiatives, such as structured antenatal classes, mobile health applications and community-based programs, are recommended to enhance maternal health literacy, support informed decision-making and reduce non-medically indicated cesarean sections.

Key Words Vaginal Delivery, Cesarean Section, Postpartum Complications, Maternal Knowledge, Antenatal Education, Hail Region, Saudi Arabia

INTRODUCTION

The choice of delivery mode is a critical determinant of maternal and neonatal health outcomes. Vaginal delivery (VD) and cesarean section (CS) are the two primary methods of childbirth; each associated with distinct benefits and risks. Over recent decades, the global rate of CS has increased markedly, raising concerns about its overuse in situations lacking clear medical indication. Saudi Arabia mirrors this international trend, with national CS rates estimated at approximately 27.5% and even higher in tertiary care hospitals [1,2]. This pattern suggests that factors beyond medical necessity, such as social beliefs, cultural influences and inadequate maternal education, play a growing role in shaping delivery choices.

In the Hail region of northern Saudi Arabia, detailed data on CS prevalence remain scarce; however, available reports and hospital-based observations indicate a similar upward trajectory. Factors contributing to this rise likely include

cultural preferences, fear of labor pain and limited awareness of the relative risks of each delivery method. Despite these challenges, the Hail region has not been comprehensively studied in terms of women's knowledge, attitudes and decision-making regarding childbirth. Examining this understudied population provides an important opportunity to understand local dynamics influencing delivery preferences and maternal health literacy.

Cultural and informational factors are central to women's decision-making about childbirth. Misconceptions persist that CS is inherently safer, less painful or more convenient, despite its association with higher surgical risk, longer recovery and potential complications in subsequent pregnancies [3–6]. Conversely, negative perceptions of vaginal delivery, such as fear of pain or concern about perineal injury, can discourage women from choosing it. These attitudes often develop in the absence of effective antenatal education and are further reinforced by inconsistent counseling from healthcare providers [4]. As a result, many women in Saudi Arabia, including those in Hail, demonstrate incomplete understanding of both delivery methods and the potential postpartum complications associated with each [5,6]. This lack of comprehensive knowledge contributes to the rising rate of elective and non-medically indicated CS, posing avoidable health and economic burdens on the healthcare system [7].

Given this context, a region-specific investigation into maternal knowledge and attitudes toward modes of delivery is warranted. The present study aims to assess women's understanding of vaginal delivery, cesarean section and postpartum complications in the Hail region and to explore the sociodemographic and cultural factors influencing these perspectives. By identifying knowledge gaps and misconceptions, this research seeks to inform the development of targeted educational interventions that promote informed maternal decision-making, reduce unnecessary cesarean deliveries and enhance safe childbirth practices in alignment with national health priorities.

LITERATURE REVIEW

The growing prevalence of cesarean sections (CS) has become a global public health concern, influenced by a combination of cultural, social and medical determinants [8]. In Saudi Arabia, including the Hail region, women's knowledge and attitudes toward delivery modes are often shaped by sociocultural expectations, limited health education and varying access to accurate obstetric information [9]. Studies consistently demonstrate that many Saudi women overestimate the safety and convenience of CS while underestimating its short- and long-term complications, such as prolonged recovery, surgical risks and potential effects on future pregnancies [10,11].

Although CS can be life-saving when medically indicated, its unnecessary use is increasingly associated with avoidable maternal and neonatal risks. The Saudi context presents particular challenges due to persistent misconceptions about childbirth and the limited availability of structured antenatal education programs [12,13]. Many women perceive CS as an easier, less painful or more modern alternative to vaginal delivery (VD), a belief often reinforced by cultural norms and fear of labor pain [10]. Similarly, international studies have identified fear of childbirth, social influence and physician preference as major contributors to elective CS even in the absence of clinical indications [11].

In the Hail region, evidence suggests that antenatal education remains fragmented and inadequately evaluated for both reach and effectiveness. Local observations and unpublished reports indicate that many expectant mothers receive minimal counseling regarding the comparative risks and benefits of VD and CS. Consequently, women often lack essential knowledge about potential complications such as perineal trauma in VD or uterine rupture in repeat CS cases [12,13]. These gaps highlight the urgent need for comprehensive, evidence-based antenatal education programs tailored to regional contexts.

Globally, countries that have implemented well-structured childbirth education initiatives, emphasizing natural childbirth, informed consent and risk awareness, tend to report lower elective CS rates [14,15]. In contrast, regions with limited maternal education or cultural preference for medicalized births exhibit persistently high CS rates. This global comparison underscores the potential for Saudi Arabia to reduce unnecessary CS deliveries through systematic, evidence-based antenatal education and the promotion of normal birth practices supported by trained healthcare professionals.

Healthcare providers also play a pivotal role in shaping women's delivery decisions. Prior research demonstrates that women often rely heavily on their physicians' advice when choosing between CS and VD [16]. However, inconsistent or hurried counseling may result in misconceptions or passive decision-making, particularly among less-educated women. Therefore, it is crucial that healthcare providers deliver accurate, balanced and culturally sensitive guidance, empowering women to participate actively in their childbirth decisions.

Collectively, the literature underscores that limited knowledge, fear of pain and insufficient antenatal education contribute substantially to the rising CS rates in Saudi Arabia. International evidence supports the effectiveness of well-designed antenatal education programs in improving maternal awareness, increasing VD rates and enhancing overall maternal health outcomes [17]. Empowering women through structured education and individualized counseling remains a cornerstone of improving maternal autonomy and reducing unnecessary surgical interventions [18]. Accordingly, strengthening antenatal education and counseling services in Hail and similar regions is essential to address persistent knowledge gaps, promote informed choices and align maternal health practices with global standards.

METHODS

Study Design

This study employed a descriptive cross-sectional design to assess the knowledge and attitudes of women in the Hail region regarding different modes of childbirth, vaginal

delivery (VD) and cesarean section (CS), and their awareness of potential postpartum complications. A quantitative approach was used to collect standardized data through structured questionnaires, allowing for an objective evaluation of participants' knowledge, perceptions and decision-making patterns.

The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional studies to ensure methodological transparency, reliability and completeness in reporting.

Study Population and Sample Size

The study population comprised women aged 18–45 years residing in the Hail region who were either currently pregnant or had previously experienced childbirth. To ensure representation across diverse sociodemographic groups, a stratified random sampling technique was used. Stratification was based on age (18–25, 26–35, 36–45 years), educational attainment (primary, secondary, university) and parity status (nulliparous, multiparous).

The sample size was calculated using Cochran's formula with a 95% confidence level and a 5% margin of error:

$$n = Z^2 \cdot p \cdot (1-p)/e^2$$

where Z = 1.96 (for 95% confidence), p = 0.5 (estimated proportion) and e = 0.05 (margin of error). This calculation produced a minimum required sample of 385 participants, which was deemed sufficient to ensure statistical precision and generalizability.

Data Collection

Data were collected between October 11 and December 28, 2024, using a validated, predesigned online questionnaire administered via Google Forms. The instrument was adapted from a previously validated study conducted in another Saudi region bearing the same title and was reviewed for face and content validity by a panel of experts in maternal health and epidemiology.

A pilot test involving 30 women was conducted to evaluate clarity, internal consistency and comprehension; these responses were excluded from the final analysis.

The questionnaire consisted of four structured sections:

- **Demographic characteristics** (age, marital status, education, occupation, parity, preferred delivery method, monthly income and self-assessed knowledge)
- **Knowledge and attitudes toward vaginal delivery**, measured using a five-point Likert scale (1 = *Strongly disagree*, 5 = *Strongly agree*). Items assessed beliefs about VD's natural acceptability, emotional bonding, recovery time, avoidance of surgical risks and long-term maternal health benefits
- **Knowledge and attitudes toward cesarean section**, using a similar Likert scale. Items covered perceptions of CS safety, convenience, avoidance of pain and stress, surgical risks and decision-making influences
- **Awareness of postpartum complications**, also assessed on a five-point Likert scale. Questions addressed complications such as endometritis, deep vein thrombosis, wound infection, bladder hematoma and uterine perforation

To ensure data quality and validity, Google Forms was configured to require completion of all items and restrict free-text input to minimize errors. The research team manually reviewed responses to identify and remove incomplete, duplicate or inconsistent entries (e.g., conflicting answers regarding parity and preferred delivery method). These quality-control procedures ensured data accuracy and integrity prior to analysis.

Data Analysis

Data analysis was performed using SPSS (Statistical Package for the Social Sciences), version 25. Descriptive statistics (frequencies, percentages, means and standard deviations) were computed to summarize demographic characteristics and levels of knowledge and attitudes.

Responses from Sections 2–4 were analyzed as continuous variables using summated Likert-scale scoring (1 = Strongly disagree, 5 = Strongly agree). Composite scores for each section were obtained by summing item responses after confirming internal consistency through Cronbach's alpha reliability testing. Reverse-coded items were adjusted to ensure uniform scoring direction, where higher scores indicated more positive attitudes or greater knowledge.

Prior to inferential analysis, data were examined for normality (Shapiro–Wilk test) and homogeneity of variance (Levene's test, $p > 0.05$). Chi-square tests and independent *t*-tests were used to explore bivariate associations between sociodemographic variables (age, education, parity, occupation) and knowledge or attitude scores. Analysis of variance (ANOVA) and multivariate logistic regression were applied where appropriate to identify predictors of knowledge and attitudes toward delivery modes and postpartum complications. A significance threshold of $p<0.05$ was adopted for all tests and 95% confidence intervals were calculated to assess statistical precision.

These analytical steps ensured that both univariate and multivariate relationships were rigorously examined, providing a comprehensive understanding of the factors influencing women's delivery preferences and awareness of potential complications.

RESULTS

The study evaluated childbirth-related knowledge and attitudes using standardized questionnaires completed by 383 women from the Hail region. Scores were computed as percentages of correct or positive responses.

Sociodemographic Characteristics

Participants had a mean age of 28.4 years (SD = 6.2), with the majority aged 18–25 years (44.9%). Over half of the respondents were married (53.0%) and 67.1% had attained post-secondary education, while 59.3% were unemployed.

In terms of reproductive history, 47.3% reported multiple pregnancies and 44.1% were nulliparous.

Regarding delivery preferences, more than half of the participants (54.6%) expressed a preference for vaginal delivery (VD), while 16.2% preferred cesarean section (CS) and 29.2% were undecided. The majority of respondents (46.0%) reported a monthly income above 10,000 SAR, whereas 36.6% rated their childbirth-related knowledge as "good" and 21.4% as "weak." Table 1 summarizes the demographic and socioeconomic characteristics of the study population.

Knowledge Levels Across Domains

Overall, participants demonstrated a moderate level of childbirth knowledge (M = 64.54, SD = 7.76), with significant variation across domains. Knowledge was highest for vaginal delivery (M = 86.45, SD = 11.86), followed by cesarean section (M = 57.70, SD = 12.16) and lowest for postpartum complications (M = 49.48, SD = 14.41).

Paired sample comparisons indicated that knowledge of VD was significantly higher than both CS (mean difference = 28.75, t [382] = 35.85, p<0.001) and postpartum complications (mean difference = 36.96, t [382] = 34.96, p<0.001), with large effect sizes (Cohen's d >1.5). Knowledge regarding CS also exceeded that of postpartum complications (mean difference = 8.21, t [382] = 9.74, p<0.001, d = 0.52). Table 2 presents the comparative domain-specific knowledge scores.

Correlational Analysis

Correlation analysis revealed significant but weak associations among the knowledge domains. A weak positive relationship was found between VD and CS knowledge (r = 0.146, p = 0.004), suggesting that familiarity with one delivery mode modestly enhanced understanding of the other. In contrast, VD knowledge was negatively correlated with postpartum awareness (r= –0.234, p<0.001), indicating that women well-informed about vaginal delivery tended to have lower awareness of postpartum

Table 1: Demographic and socioeconomic characteristics

Variables	Number	Percent
Age		
18-25 years	172	44.9
26-30 years	26	6.8
31-35 years	25	6.5
36-40 years	52	13.6
41-45 years	61	15.9
Over 45 years	47	12.3
Marital Status		
Single	161	42
Married	203	53
Divorced	15	3.9
Widowed	4	1
Education		
High school or less	126	32.9
Above high school	257	67.1
Occupation		
Unemployed	227	59.3
Employed	156	40.7
Parity Status		
Never pregnant	169	44.1
Once	33	8.6
Multiple times	181	47.3
Preferred Delivery Method		
Natural delivery	209	54.6
Cesarean delivery	62	16.2
Don't know	112	29.2
Monthly Income		
Less than 5,000 SAR	72	18.8
5,000–10,000 SAR	135	35.2
More than 10,000 SAR	176	46
Self-Evaluation of Knowledge		
Weak	82	21.4
Good	140	36.6
Very good	114	29.8
Excellent	47	12.3

Table 2**:** Paired t-test comparisons of women's knowledge scores (N = 383).

Comparison	Mean Difference (SD)	p-value
Vaginal Birth - Cesarean Section	28.75 (15.70)	<0.001
Vaginal Birth - Postpartum Complications	36.96 (20.69)	<0.001
C-Section - Postpartum Complications	8.21 (16.50)	<0.001

Paired comparisons of childbirth knowledge domain scores using t-tests (N = 383). All comparisons significant at p<0.05; Mean difference calculated as first-listed domain minus second-listed domain; SD = standard deviation of the mean difference.

Table 3: Knowledge Scores by Marital Status (Mean (SD) and ANOVA Results

Knowledge Domain	Single (n=161)	Married (n=203)	Divorced (n=15)	Widowed (n=4)
Total Knowledge	61.97 (7.34)	66.55 (7.25) *	64.77 (9.44)	65.22 (14.28)
Vaginal Birth	81.05 (12.42)	90.53 (9.82) *	88.38 (8.54)	89.29 (11.75)
Cesarean Section	55.03 (11.82)	59.98 (11.96) *	56.33 (11.13)	54.38 (20.25)
Postpartum	49.84 (14.57)	49.14 (14.22)	49.60 (13.51)	52.00 (24.66)

Knowledge scores by marital status with ANOVA results (Mean±SD). *Indicates significant difference (p<0.05) from single group in post-hoc Tukey tests; ANOVA results for total knowledge: F (3,379) = 14.32, p<0.001, η^2 = 0.10; ANOVA results for vaginal birth: F (3,379) = 25.44, p<0.001, η^2 = 0.17; Widowed group excluded from post-hoc tests due to small sample size (n = 4)

Table 4: Comparison of Childbirth Knowledge Scores (Mean (SD) by Education Level

Knowledge Domain	High School or Less (n = 126)	Post-Secondary (n = 257)	p-value
Total Knowledge Score	62.1 (7.3)	67.2 (6.8)	<0.001
Vaginal Delivery Knowledge	81.2 (12.4)	89.4 (9.1)	<0.001
Cesarean Section Knowledge	54.9 (12.3)	59.8 (11.2)	<0.001
Postpartum Complications	47.2 (14.6)	51.1 (13.8)	0.015

Knowledge score comparisons by education level (Mean ± SD). Independent samples t-tests conducted for all comparisons; post-secondary education includes diploma, bachelor's and graduate degrees

Table 5: Knowledge Score Differences (Mean (SD) by Employment Status.

Knowledge Domain	Unemployed (n = 227)	Employed (n = 156)	p-value
Total Knowledge	63.37 (8.08)	66.25 (6.93)*	<0.001
Vaginal Birth	84.07 (12.33)	89.91 (10.23)*	<0.001
Cesarean Section	55.88 (12.46)	60.34 (11.23)*	<0.001
Postpartum	50.15 (15.05)	48.51 (13.40)	0.265

Knowledge score differences by employment status (Mean±SD), *Indicates statistically significant difference (p<0.05)

complications. Conversely, CS knowledge showed a positive correlation with postpartum awareness ($r = 0.237$, $p<0.001$), implying that understanding surgical delivery was associated with slightly greater recognition of postoperative risks.

Sociodemographic Influences on Knowledge

Age: Age significantly influenced knowledge scores. Women aged 36–45 years demonstrated superior total knowledge ($F [5,377] = 11.75$, $p<0.001$) and a stronger understanding of vaginal delivery ($F [5,377] = 13.16$, $p<0.001$) compared with younger participants aged 18–25 years, suggesting that experience and parity enhance maternal awareness.

Marital Status

Marital status also yielded significant differences. Married women scored higher in both total knowledge (mean difference = 4.58, $p<0.001$) and vaginal birth understanding (mean difference = 9.48, $p<0.001$). Table 3 presents the comparison of knowledge scores by marital status.

Education Level

Educational attainment was a strong predictor of knowledge. Women with post-secondary education exhibited significantly greater understanding across all domains, vaginal birth ($t [381] = 7.12$, $p<0.001$, $d = 0.73$) and total knowledge ($t [381] = 5.67$, $p<0.001$, $d = 0.58$). These comparisons are detailed in Table 4.

Employment Status

Employment status further differentiated knowledge levels. Employed women demonstrated significantly higher total knowledge ($t [363] = –3.74$, $p<0.001$, $d = 0.38$) and better understanding of vaginal delivery ($t [368] = –5.05$, $p<0.001$, $d = 0.51$) than unemployed participants. Table 5 presents the corresponding results.

Postpartum Knowledge

Despite the influence of demographic variables on overall and domain-specific knowledge, postpartum awareness remained consistently low across all groups. Regardless of age, marital status, educational level or employment, participants exhibited limited understanding of postpartum risks, such as infection, hemorrhage and deep vein thrombosis. This finding underscores a universal educational gap in postpartum health knowledge among women in the Hail region.

DISCUSSION

This study examined the knowledge and attitudes of women in the Hail region of Saudi Arabia regarding modes of delivery and associated complications. The findings revealed that a majority of participants (54.6%) preferred vaginal delivery (VD), while 16.2% favored cesarean section (CS) and 29.2% were uncertain about their preferred method. These preferences align with global evidence suggesting that VD remains the most favored mode of childbirth due to its advantages of faster recovery, reduced surgical risk and better neonatal outcomes [19,20]. However, despite this preference, significant gaps in knowledge were identified, particularly concerning CS and postpartum complications.

The mean knowledge scores indicated a markedly higher awareness of VD ($M = 86.45$) compared with CS ($M = 57.69$) and postpartum complications ($M = 49.48$). This disparity suggests that while women may instinctively prefer vaginal birth, their understanding of the relative risks and benefits across delivery modes remains incomplete [21,22]. Limited knowledge, particularly of CS and postpartum complications, may hinder informed decision-making and perpetuate misconceptions about childbirth. These results highlight the need for enhanced educational strategies that go beyond preference formation to support evidence-based maternal choices.

Correlation analyses demonstrated weak associations between knowledge domains, indicating that awareness of one aspect of childbirth does not necessarily extend to others. In other words, familiarity with vaginal birth did not predict awareness of cesarean delivery or postpartum complications. This fragmented understanding underscores the need for integrated maternal education programs that holistically address prenatal, delivery and postnatal topics [23]. Evidence from other regions supports this approach, showing that comprehensive maternal health education improves confidence in decision-making, enhances pregnancy outcomes and reduces unnecessary CS rates [24,25].

Sociodemographic factors significantly influenced knowledge levels. Age emerged as an important determinant: older women displayed higher awareness of both VD and CS, likely due to accumulated personal experience and greater exposure to maternal health information [26]. Marital status also influenced understanding, with married women exhibiting higher knowledge scores, possibly because of direct exposure to pregnancy, delivery experiences and interactions with healthcare providers [27].

Similarly, education played a crucial role. Women with post-secondary education showed superior knowledge of VD and CS, confirming that higher education enhances maternal health literacy [28]. Employment status also correlated with greater awareness, employed women were more knowledgeable, perhaps reflecting better access to health information and digital resources [29]. Parity was another influential variable, as multiparous women demonstrated greater understanding of delivery modes compared to nulliparous participants, reinforcing that experience strengthens maternal awareness [30].

Despite these differences, awareness of postpartum complications remained consistently low across all demographic groups. This finding highlights a pervasive educational gap and suggests that postpartum health topics are often underrepresented in antenatal education and clinical consultations [31]. In Saudi Arabia, such gaps may be compounded by limited discussions of postpartum issues during routine antenatal care, where the focus is typically on pregnancy and delivery rather than the recovery period.

Persistent misconceptions regarding cesarean section were also observed. While CS can be life-saving when medically necessary, its increasing global prevalence raises concerns about elective procedures performed without clear medical justification. Existing research demonstrates that increased maternal awareness of the risks associated with unnecessary CS, such as surgical complications, infections, delayed recovery and neonatal respiratory distress, can contribute to reducing elective CS rates [32,33].

Cultural and social dynamics in Saudi Arabia may further shape women's delivery preferences. Some women opt for CS due to misconceptions about vaginal birth being risky or overly painful, while others face familial or societal pressures that portray CS as a more convenient or prestigious option [34]. These findings emphasize the intersection of cultural beliefs, knowledge gaps and healthcare communication in shaping delivery decisions.

While this study provides valuable regional insights, certain limitations should be acknowledged. The cross-sectional design precludes causal inference and the online data collection method may have excluded women with limited internet access or lower digital literacy, potentially biasing the sample toward more educated participants. Nevertheless, the study's large sample size, validated instrument and regional focus offer meaningful evidence to inform maternal health policy and practice.

Overall, this research underscores the urgent need for enhanced maternal education initiatives in the Hail region. Antenatal care should include structured educational programs that focus on delivery options and postpartum health. Such interventions can take the form of interactive antenatal classes, mobile health applications and community-based awareness campaigns tailored to local cultural contexts. Targeting younger, single, less educated, unemployed and nulliparous women is especially important to bridge the identified knowledge gaps [35,36].

CONCLUSIONS

This study identified significant deficiencies in women's knowledge regarding childbirth methods and postpartum complications in the Hail region of Saudi Arabia. Although the majority preferred vaginal delivery, understanding of cesarean section risks and postpartum health remained limited. Knowledge levels were significantly influenced by factors such as age, marital status, education, employment and parity, but deficiencies persisted across all demographic categories in the domain of postpartum awareness.

These findings suggest that many women in Hail may not be making fully informed decisions regarding their mode of delivery, particularly concerning cesarean-related risks and postpartum health issues. The weak correlations between knowledge domains reinforce the necessity for integrated maternal health education that combines antenatal, delivery and postnatal information in a cohesive manner.

To address these gaps, healthcare policymakers and practitioners should prioritize the development and implementation of structured antenatal education programs that emphasize the benefits and risks of both delivery methods and highlight postpartum health concerns. Such programs should be culturally tailored and targeted toward subgroups with lower knowledge levels, specifically younger, less educated, single, unemployed and first-time mothers.

Expanding access through digital education tools, community outreach and collaboration with healthcare providers, midwives and public health campaigns can significantly improve maternal health literacy. These interventions will empower women to make informed, confident decisions regarding childbirth and align with the World Health Organization's recommendations to reduce medically unnecessary cesarean sections and promote safe, woman-centered maternity care.

Integrating these educational strategies into the national maternal health framework will help ensure that all women, regardless of background, have access to accurate, comprehensive and empowering childbirth information, ultimately improving maternal and neonatal outcomes across Saudi Arabia.

Strengths of the Study

This study possesses several notable strengths that enhance its methodological rigor, credibility and regional relevance.

First, the sample size (n = 383) exceeded the minimum requirement established through Cochran's formula, thereby ensuring adequate statistical power and enhancing the generalizability of findings within the Hail region.

Second, the use of a stratified random sampling technique enabled the inclusion of women across diverse age groups, educational backgrounds, employment statuses and parity levels. This approach strengthened representativeness across sociodemographic subgroups and minimized selection bias, ensuring a balanced and comprehensive dataset.

Third, unlike many similar studies that focus solely on delivery mode preferences, this research uniquely incorporated an additional domain assessing knowledge of postpartum complications. This inclusion allowed for a more holistic understanding of maternal health literacy, emphasizing an often-overlooked component of maternal well-being.

Fourth, the regional focus on the Hail area represents a novel contribution to the literature. Few previous studies have investigated women's childbirth knowledge and attitudes within this specific population. This regional emphasis generates context-specific insights that can guide locally tailored maternal health policies and educational interventions.

Finally, the questionnaire instrument was adapted from previously validated tools and reviewed by experts in maternal health and epidemiology. This ensured both content validity and comparability with earlier Saudi and international studies, thereby enhancing reliability and external validity.

Weaknesses of the Study

Despite its strengths, several limitations must be acknowledged.

First, the cross-sectional design inherently limits the ability to infer causal relationships between sociodemographic factors and knowledge or attitude levels. The findings thus represent associations rather than direct causal effects.

Second, the online-only data collection method may have introduced selection bias, as women with limited internet access, low digital literacy or those residing in rural areas might have been underrepresented. Consequently, the findings may be more reflective of urban, educated populations.

Third, the reliance on self-reported data introduces the potential for recall bias and social desirability bias. Participants may have overestimated their knowledge or provided responses aligned with socially accepted norms regarding delivery preferences, thereby influencing data accuracy.

Fourth, while the inclusion of postpartum complications was a key strength, the questionnaire items may not have comprehensively captured the full range of potential postpartum issues. This limitation could contribute to underestimating women's awareness in this critical domain.

Fifth, underrepresentation of certain demographic groups, particularly older women and those with lower income or educational attainment, restricts the generalizability of results to the broader population of the Hail region.

Lastly, the absence of qualitative or follow-up data limits understanding of the underlying motivations, beliefs and cultural factors shaping women's delivery preferences and misconceptions. A mixed-methods approach incorporating interviews or focus groups could have provided deeper contextual insights into the drivers of maternal decision-making.

Innovation and Contribution of the Study

This research makes several innovative and meaningful contributions to the growing body of maternal health literature in Saudi Arabia.

Foremost, it is among the few studies focusing specifically on the Hail region, filling a critical gap in localized evidence regarding women's knowledge and attitudes toward childbirth. This region-specific perspective enables the formulation of tailored public health strategies that address local cultural, educational and healthcare dynamics.

A second innovative feature is the study's three-dimensional framework, which examines women's knowledge and attitudes toward vaginal delivery, cesarean section and postpartum complications. The inclusion of postpartum awareness, often neglected in similar research, enhances the study's comprehensiveness and practical utility in guiding holistic antenatal education.

Third, the study's stratified analysis of demographic variables such as education, employment, age and parity offers granular insights into which subgroups exhibit lower maternal health literacy. These findings can directly inform targeted intervention strategies, ensuring efficient allocation of educational and healthcare resources.

Furthermore, the identification of weak correlations between knowledge domains highlights a fragmented pattern of maternal understanding, revealing that awareness of one childbirth dimension does not necessarily translate to broader maternal literacy. This insight provides a strong empirical foundation for developing integrated antenatal education programs that address childbirth and postpartum health as interconnected experiences.

Finally, this study aligns its conclusions with broader public health priorities, including the reduction of unnecessary cesarean deliveries and the promotion of evidence-based, woman-centered maternity care, in accordance with World Health Organization (WHO) guidelines and Saudi Vision 2030's healthcare transformation objectives. In doing so, it provides actionable evidence to support policy enhancement, healthcare training and community-level education aimed at improving maternal and neonatal outcomes nationwide.

Implications for Practice

The findings of this study carry important implications for maternal health practice, antenatal education and policy development in the Hail region and similar settings across Saudi Arabia.

First, the results underscore an urgent need for structured, evidence-based antenatal education programs that extend beyond discussions of delivery modes to include postpartum risks and complications. Such programs should be standardized and integrated into routine antenatal care across public and private healthcare facilities. Healthcare providers, including obstetricians, midwives, nurses and health educators, should be trained to deliver these sessions consistently and effectively during regular prenatal visits.

Second, targeted outreach efforts should prioritize subgroups identified as having lower knowledge levels, including younger, single, nulliparous, less-educated and unemployed women. Educational content should be presented in simple, culturally appropriate Arabic, supported by visual aids, infographics and short videos to facilitate comprehension. Mobile applications and social media channels can further expand accessibility.

Third, digital health interventions should be leveraged to promote maternal awareness. Tools such as WhatsApp-based reminders, mHealth applications, virtual antenatal classes and interactive chatbots can help deliver accurate, timely information, particularly in rural or remote areas. Given Saudi Arabia's high smartphone penetration, these technologies represent a powerful avenue to reach underserved populations and sustain continuous maternal engagement.

Fourth, the involvement of male partners and family members in antenatal education can enhance shared decision-making and reduce cultural barriers surrounding childbirth choices. Integrating family-oriented modules within prenatal sessions could promote collective understanding and informed support for evidence-based delivery practices.

Finally, policy-level initiatives are essential. The Ministry of Health should consider embedding antenatal education as a mandatory component of national maternal care standards. This would ensure equitable access to maternal health information, align with Saudi Vision 2030's goals for health system modernization and support WHO's recommendations for improving maternal and neonatal outcomes through informed, woman-centered care.

Limitations

Despite its contributions, several limitations should be acknowledged when interpreting this study's findings.

First, the cross-sectional design restricts the ability to infer causal relationships between sociodemographic characteristics and knowledge or attitude outcomes. The associations identified should thus be interpreted as correlational.

Second, the online survey format may have introduced sampling bias, as participants without internet access or digital literacy, particularly older or rural women, may have been underrepresented. Consequently, the sample may overrepresent urban, educated populations.

Third, reliance on self-reported data introduces potential recall and social desirability biases, especially concerning personal knowledge or preferences about childbirth. Some participants may have overestimated their understanding or provided socially acceptable responses.

Fourth, although postpartum complications were included as a domain, the questionnaire's scope may not have captured the full range of possible postpartum risks. This may partially explain the low awareness levels observed in this area.

Fifth, certain demographic subgroups, such as women aged over 40 years or those from lower-income strata, were underrepresented relative to their actual population proportions in the region, limiting the generalizability of findings to these groups.

Finally, the absence of qualitative or longitudinal follow-up data limited the ability to explore underlying motivations, beliefs and cultural influences shaping women's knowledge and attitudes. Including interviews or focus groups in future research could yield deeper insights into the social and cultural determinants of maternal decision-making.

Future Recommendations

Building on the findings and limitations of this research, several strategic recommendations are proposed to enhance maternal health literacy and improve childbirth outcomes in the Hail region and similar Saudi contexts:

- Develop and implement structured antenatal education programs
- Design standardized educational interventions addressing the risks and benefits of both vaginal and cesarean delivery, as well as postpartum complications. These programs should be delivered through hospitals, community health centers and mobile health platforms to ensure wide accessibility
- Tailor content for specific demographic groups
- Focus on subpopulations with lower knowledge scores, particularly younger, nulliparous, less-educated and unemployed women. Develop materials that are linguistically simple, visually engaging and culturally sensitive to maximize comprehension and relevance
- Leverage digital health technologies
- Utilize mobile health applications, SMS or WhatsApp reminders and virtual antenatal classes to expand reach, especially to rural or remote communities. Integrating these tools into existing healthcare systems can improve continuity of education and patient engagement
- Integrate male and family participation
- Encourage the inclusion of husbands and family members in maternal education initiatives to foster shared decision-making and reduce culturally driven misconceptions surrounding childbirth
- Conduct longitudinal and qualitative studies
- Future research should include follow-up assessments and qualitative interviews to explore the evolution of maternal attitudes over time and uncover deeper social, psychological and cultural influences affecting childbirth preferences
- Facilitate regional and national comparisons
- Multi-regional or nationwide studies should be conducted to compare maternal knowledge and attitudes across different provinces. Such comparisons will help identify geographic disparities and inform unified national education policies
- Align health policies with WHO standards
- The Ministry of Health should review and adapt current maternal health policies in accordance with World Health Organization guidelines, emphasizing the reduction of medically unnecessary cesarean deliveries and promoting informed, evidence-based and woman-centered care [35,36]

Ethical Statement

Ethical approval was obtained from the Research Ethics Committee (REC) at the University of Hail on October 10, 2024, under approval number H-2024-480. The study titled "Knowledge and Attitude Toward Modes of Delivery and Possible Complications Among Women in Hail Region, Saudi Arabia" was reviewed to ensure compliance with institutional and national ethical standards.

All participants provided informed consent prior to participation. They were assured of confidentiality, anonymity and voluntary participation, with the right to withdraw at any stage without penalty. Responses were

collected anonymously through Google Forms and no personally identifiable data were obtained. Although responses were stored securely online, the absence of advanced encryption tools was acknowledged as a limitation in data protection.

The online questionnaire was designed to ensure anonymity; no personally identifiable information was collected or stored. Responses were accessible only to the research team through password-protected Google Forms accounts. Although no specialized data-encryption tools were employed, the platform's inherent security settings ensured basic data protection.

The study involved minimal risk as it required no physical interaction or invasive procedures. To protect potentially vulnerable participants, such as younger or less-educated women, the questionnaire was carefully worded in clear, non-technical Arabic to maximize comprehension and minimize discomfort.

Overall, ethical safeguards were rigorously maintained to protect participants' privacy, autonomy and well-being, reinforcing the study's adherence to institutional and national ethical standards.

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APPENDIX

Structured Questionnaire Used in the Study

The following questionnaire was utilized in the research titled "Knowledge and Attitude Toward Modes of Delivery and Possible Complications Among Women in the Hail Region, Saudi Arabia." It was adapted from a previously validated instrument used in similar Saudi-based studies, with modifications to enhance cultural and contextual relevance to the Hail population. The final version was translated into Arabic and administered electronically via Google Forms.

Section 1: Demographic Information

Please select the response that best applies to you.

1. **Age**
   ☐ 18–25 ☐ 26–35 ☐ 36–45
2. **Marital Status**
   ☐ Single ☐ Married ☐ Divorced ☐ Widowed
3. **Educational Level**
   ☐ Primary ☐ Secondary ☐ Diploma ☐ Bachelor's Degree ☐ Postgraduate
4. **Employment Status**
   ☐ Employed ☐ Unemployed ☐ Student ☐ Housewife
5. **Monthly Household Income (SAR)**
   ☐ <3,000 ☐ 3,000–6,000 ☐ 6,001–10,000 ☐ >10,000
6. **Number of Pregnancies (Parity)**
   ☐ 0 ☐ 1–2 ☐ 3–4 ☐ >4
7. **Preferred Mode of Delivery**
   ☐ Vaginal Delivery ☐ Cesarean Section ☐ Unsure
8. **Have You Previously Given Birth?**
   ☐ Yes ☐ No
9. **If Yes, What Mode of Delivery Have You Experienced?**
   ☐ Vaginal ☐ Cesarean ☐ Both
10. **Do You Feel Knowledgeable About Childbirth Options and Risks?**
    ☐ Yes ☐ No ☐ Somewhat

Section 2: Knowledge and Attitudes Toward Vaginal Delivery
Response Scale:

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

1. Vaginal delivery is the natural method of giving birth.
2. Vaginal delivery helps in faster maternal recovery.
3. Vaginal delivery promotes stronger emotional bonding between mother and child.
4. Vaginal delivery avoids the risks associated with surgical procedures.
5. Vaginal delivery has fewer long-term complications than cesarean delivery.
6. I would prefer to avoid a surgical scar on my abdomen.
7. Vaginal delivery involves severe labor pain.

Section 3: Knowledge and Attitudes Toward Cesarean Section
Response Scale:

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

1. Cesarean delivery is safer than vaginal delivery.
2. Cesarean delivery helps avoid labor pain and psychological stress.
3. Cesarean delivery involves fewer complications.
4. Cesarean delivery requires a longer recovery period.
5. Cesarean section should be performed only when medically necessary.
6. A woman should have the right to choose cesarean delivery even without medical indication.
7. Cesarean delivery can affect future pregnancies.

Section 4: Awareness of Postpartum Complications
Response Scale:

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

1. Endometritis (infection of the uterus) is a possible complication after childbirth.
2. Deep vein thrombosis (DVT) can occur after delivery.
3. There is a risk of excessive bleeding following childbirth.
4. Cesarean section may lead to bladder hematoma.
5. Cesarean section increases the risk of surgical wound infection.

Uterine perforation may occur as a result of medical error during cesarean delivery.